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SECTION VII.—WEATHER AND DATA FOR THE MONTH.

THE WEATHER OF JULY, 1917.

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PRESSURE AND WINDS.

The distribution of the mean atmospheric pressure over the United States and Canada, and the prevailing direction of the winds are graphically shown on Chart VII (xlv-74) while the average values for July, 1917, at the several stations, with departures from the normal, are shown on Tables I and III.

At the beginning of the month low barometric pressure obtained in the region of the Great Lakes and over the eastern Canadian Provinces, but a high-pressure area of considerable magnitude, for the season of the year, occupied the far Northwest and moved thence during the following few days slowly eastward over the central and northern districts. During much of the time from the 6th to the middle of the third decade stagnant pressure conditions obtained with relatively low values persisting in most sections of the country, specially east of the Mississippi River, and with a high-pressure area overlying the ocean to the east. There was no well-defined storm movement during the month, although at the close a rather marked low-pressure area had advanced from the far Northwest to the upper Mississippi Valley.

For the month as a whole the pressure averaged below the normal generally, except in the Atlantic and Gulf Coast States, where it was mostly normal or slightly above, also the case in some sections of the Rocky Mountain and Plateau districts of the West. The negative departures were rather marked in the northern border States from the Great Lakes westward to the Rocky Mountains, in the central Mississippi and lower Missouri Valleys.

The distribution of atmospheric pressure during the month was such as to favor frequent southerly winds, and these prevailed in all sections of the country except in some far western districts and locally elsewhere.

TEMPERATURE.

During the first decade of July, 1917, temperature was below the monthly average generally east of the Mississippi River and above that value in the West. The weather was specially cool in the region of the Great Lakes and warm in the Plateau districts of the West. West of the Rocky Mountains, hot weather continued throughout the second decade, the week ending July 17 being specially warm in Nevada and eastern Oregon, where the temperature for the week averaged 9 to 12 degrees above normal. In the Lakes Region the unseasonably cool weather, which had persisted for about two months, continued until near the end of the second decade, when warmer weather set in. During the latter part of the third decade the hot period that had persisted for more than a month in the far West, came to an end. About the same time much warmer weather set in over most eastern districts, the afternoon temperatures rising to 100°, or higher, in the middle and lower Missouri and upper Mississippi Valleys, and reach-

ing nearly 100° at many points in the Middle Atlantic and Northeastern States.

For July, as a whole, the temperature averaged above the July normal in all districts, except in most of Michigan and the lower Lakes Region, the Ohio and middle Mississippi Valleys, and the Middle Atlantic States, where it was deficient. The negative departures were not marked, however, being generally less than 3 degrees. The greatest positive departures occurred in portions of Nevada and California, where the month was 6 degrees or more warmer than the July average.

The cool weather during much of the month in eastern districts was due to the prevalence of cloudy weather, which prevented the day temperatures from going as high as they usually do in July. On the other hand there was an unusually large amount of sunshine in much of the Plains Region, in the central, and the northern Plateau district of the West; consequently the day temperatures in those sections were persistently higher than those usually experienced there in July.

PRECIPITATION.

During the first two decades of July, 1917, there was abundant rainfall over nearly all the great agricultural districts from the Plains States eastward. In fact, rain persisted to such an extent as greatly to interfere with farming operations, especially in the more eastern districts; there was urgent need of dry weather to permit the completion of harvesting, the gathering of small grains, haying, and much needed cultivation of all growing crops.

In the western districts, however—especially in the Plains States, and from the Dakotas westward to the Pacific—the rainfall was exceedingly light. In Kansas this July and the two-months period June-July, were the driest ever recorded in the State. The drought conditions were further intensified in many sections of the Plains Region by the frequent occurrence of hot, dry winds, which greatly increased evaporation from the soil. In western South Dakota, over much of North Dakota, Montana, and the far Northwest, where considerable rainfall usually occurs during midsummer, the July precipitation was exceedingly small, and severe drought existed in many portions of these States at the end of the month. In much of Texas and thence westward to and including the greater part of New Mexico the month was without beneficial rain; in fact, over portions of this area the precipitation has been deficient for many months, the soil is unusually dry, the cattle ranges are poor, and water scarce. In Arizona, portions of Utah and Colorado, the usual summer rains were very generally reported.

For July as a whole the precipitation was far in excess of the normal fall over the Atlantic coast districts from southern New England to northern Florida, over portions of the Gulf States, the Mississippi and Ohio Valleys. It was approximately normal over most other districts east of the Plains States, over Arizona and portions of adjoining States. Over much of the Great Plains region and thence northwestward the precipitation was nearly everywhere below the normal and in some districts the amounts for the month were the least of record.

RELATIVE HUMIDITY.

Over the districts from the Mississippi River eastward, due to much cloudy weather and frequent showers, the relative humidity was nearly everywhere above the normal. West of the Mississippi, except over Arizona and portions of some adjoining States, the relative humidity was very generally far below the average. This was particularly true for the Great Plains, Montana, and Wyoming, where the deficiencies frequently amounted to 10 to 20 per cent. This dry condition of the atmosphere, together with an unusual amount of wind movement in portions of the central Plains States, favored rapid evaporation of soil moisture and growing vegetation suffered greatly thereby.

GENERAL SUMMARY.

On the whole during July, 1917, the weather over the central and eastern districts was—nearly everywhere—favorable for plant growth, due to a plentiful supply of soil moisture and to moderate temperature conditions. In portions of the corn belt, particularly in Iowa and thence eastward the early part of the month favored rapid crop growth, but corn continued late on account of persistent cool weather. The hot wave in the latter part of the month, especially the warm nights, greatly favored both growth and development and at the end of the month the crop was reported in splendid condition and nearly up to the stage of growth normal for the end of July.

In portions of the western corn belt, especially in Kansas and parts of surrounding States, the lack of rain and the continued hot, drying winds greatly injured corn and other growing crops. Farther north, in the spring-wheat region, lack of rain and intense heat forced the growing wheat too rapidly and seriously injured the quality of the grain, especially over the more western districts. The continued showery weather over eastern districts materially interfered with the gathering and threshing of the grain crop, but in the more western States this work made rapid progress.

In the Cotton States the weather, on the whole, was favorable and the general condition of the cotton crop remained about as reported at the end of June.

The severe heat of the last few days of the month caused much suffering and many deaths in the larger cities of the northeastern States, the temperatures during this period being as high as, or higher than, previously recorded at a number of points. This was particularly true of the night temperatures, which were in many cases likewise the highest ever observed in July.

SEVERE LOCAL STORMS.

The following notes of severe storms during July, 1917, have been extracted from reports by officials of the Weather Bureau:

Illinois.—A damaging wind and hail storm of tornadic character occurred on July 13 in Rock Island County. The storm covered an area of about 2½ miles wide and 6 miles long. It seriously injured all growing crops, some farms suffering total loss. The estimated loss was about \$75,000 in all.

On the same afternoon another storm of like nature destroyed residences and crops in Champaign and Vermilion Counties, with several persons injured and one reported fatality. Nearly every residence in Fairmont, Champaign County, was damaged; trees were laid flat, and miles of telephone poles were stripped.

Indiana.—A number of local storms occurred, causing some damage by wind, hail, or heavy rain, and at least one

of these—in the northern portion of Brown County—was of a tornadic type.

New England.—During a storm on July 21 at North Bridgton, Me., 3.11 inches of rain fell between 3 and 6 p. m.; at Holyoke, Mass., 4.67 inches fell in 2½ hours. Severe hail storms and high winds occurred in portions of the Connecticut Valley, seriously damaging growing crops.

New York.—Thunderstorms were unusually frequent in all sections of the State and in some cases they were severe. Several deaths were reported from their destructive effects, while crops suffered from the sudden heavy falls of rain and severe gusty winds.

Wisconsin.—Unusually heavy rainfall occurred in Vernon County, most of it in connection with severe thunderstorms on July 21 and 22. Severe freshets in the rivers and creeks were the result, with damages to property estimated at \$150,000.

Average accumulated departures for July, 1917.

Districts.	Temperature.			Precipitation.			Cloudiness.		Relative humidity.	
	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure from the normal.	General mean for the current month.	Departure from the normal.
	° F.	° F.	° F.	In.	In.	In.	0-10		P. ct.	
New England.....	69.7	+0.8	-11.5	2.35	-1.20	-0.50	5.8	+0.7	82	+2
Middle Atlantic.....	71.6	-0.1	-4.8	5.03	+0.70	-1.10	6.3	+1.4	79	+6
South Atlantic.....	78.9	-0.2	+5.2	7.31	+1.30	-3.30	5.6	+0.8	82	+3
Florida Peninsula....	82.1	+0.2	+3.2	3.50	-2.90	-10.40	4.1	-0.9	75	-3
East Gulf.....	80.2	-0.1	+4.0	5.09	+0.40	-1.70	5.5	+0.1	78	0
West Gulf.....	82.7	+0.8	+2.7	3.73	+0.60	-7.30	3.6	-0.7	69	-6
Ohio Valley and Tennessee.....	75.1	-1.4	-10.6	4.28	+0.30	+2.70	5.4	+0.6	75	+4
Lower Lakes.....	71.4	-0.3	-17.4	2.63	-0.80	+0.50	4.7	+0.1	74	+4
Upper Lakes.....	67.8	0.0	-21.3	2.91	-0.20	-1.20	4.8	+0.1	78	+5
North Dakota.....	71.9	+2.8	-12.3	1.07	-1.80	-6.50	3.2	-1.0	61	-5
Upper Mississippi Valley.....	75.2	-0.2	-16.1	3.40	-0.20	-0.10	4.2	-0.2	70	+1
Missouri Valley.....	77.7	+2.0	-5.8	1.85	-2.00	-2.90	2.7	-1.5	60	-5
Northern slope.....	71.7	+3.6	-16.9	0.62	-0.90	-0.30	3.0	-0.7	48	-8
Middle slope.....	79.3	+2.6	-3.5	1.56	-1.40	-5.10	3.5	-0.6	51	-10
Southern slope.....	82.7	+2.2	+2.9	1.00	-1.80	-4.70	2.9	-1.3	47	-13
Southern Plateau.....	80.8	+1.8	-9.1	1.07	-0.20	-1.10	4.3	+0.9	43	+3
Middle Plateau.....	78.6	+3.8	-28.7	0.40	-0.10	-1.00	2.9	-0.1	36	0
Northern Plateau.....	74.7	+3.8	-19.9	0.40	-0.40	-1.00	2.4	-0.4	38	-5
North Pacific.....	64.1	+1.2	-12.1	0.20	-0.50	-5.00	3.2	-1.4	68	-7
Middle Pacific.....	67.8	+2.3	-7.9	0.00	0.00	-6.20	2.8	-0.1	55	-6
South Pacific.....	73.4	+3.5	-1.0	0.00	0.00	-2.30	2.9	+0.2	64	0

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WEATHER CONDITIONS OVER THE NORTH ATLANTIC OCEAN DURING JULY, 1916.

The data for the North Atlantic Ocean presented are for July, 1916, and comparison and study of the same should be in connection with those appearing in the REVIEW for that month. Chart IX (xlv—75) shows for July, 1916, the average pressures, temperatures, and prevailing directions of the wind at 7 a. m., 75th meridian time (Greenwich mean noon), together with notes on the locations and courses of the more severe storms of the month.

PRESSURE.

The distribution of the average monthly pressures as shown on Chart IX differed but little from the normal in the middle and higher latitudes, although the West Indies hurricanes that prevailed during the month were respon-

sible for slightly lower pressures than usual in the Caribbean Sea and Gulf of Mexico. The North Atlantic high was practically normal in intensity, position, and extent, while the isobar of 29.9 inches was slightly north of its usual location and marked the southern limits of the Icelandic Low. The pressure changes from day to day were pronounced in the upper latitudes and over a large area in midocean, while in the vicinity of the Azores and in equatorial regions the range was comparatively small. The average pressure for each of the three decades differed considerably in some localities, and especially north of the 60th parallel. The following table gives the mean pressure for the three decades of the month for different 5-degrees squares, as well as the highest and lowest reported individual readings during the month within the respective squares.

Pressures over the North Atlantic during July, 1916, by 5-degree squares.

Position of 5-degree squares.		Decade means.			Extremes.			
		I	II	III	Highest.		Lowest.	
					Pressure.	Date.	Pressure.	Date.
Latitude.	Longitude.	Inches.	Inches.	Inches.	Inches.	July.	Inches.	July.
60-65 N	20-25 W	30.00	29.75	29.77	30.11	3	29.58	15, 25
60-65 N	10-15 W	29.92	29.84	29.93	30.20	23	29.68	10
60-65 N	0-5 E	29.79	29.88	30.09	30.21	22, 24	29.66	9
55-60 N	35-40 W	30.05	29.77	29.91	30.22	9	29.48	15
50-55 N	0-5 E	29.82	30.01	30.19	30.33	29	29.60	8
45-50 N	60-65 W	29.88	29.97	30.00	30.32	15	29.60	1, 21
45-50 N	40-45 W	30.03	30.04	30.09	30.38	17	29.70	5
45-50 N	5-10 W	29.94	30.21	30.25	30.42	29	29.84	8
40-45 N	15-20 W	30.10	30.32	30.25	30.42	23, 29	29.90	7
35-40 N	40-45 W	30.29	30.32	30.31	30.43	8, 11	30.12	1
30-35 N	55-60 W	30.17	30.23	30.28	30.40	24	30.08	1, 6
30-35 N	25-30 W	30.23	30.31	30.21	30.41	14	30.09	25
25-30 N	80-85 W	29.96	29.99	30.02	30.09	25	29.82	4
20-25 N	70-75 W	30.01	29.95	30.02	30.09	26	29.80	16, 17
15-20 N	35-40 W	30.09	30.02	30.03	30.20	2, 3	29.98	7, 13, 18

The mean and extreme pressures presented in the above table are based on the daily interpolated values for each square as given on the MS daily synoptic charts of the North Atlantic compiled by the Marine Section of the Weather Bureau.

GALES.

Usually July has fewer gales than any other month except June; and in July, 1916, the number of gales was below even the average for the month over the greater part of the Atlantic lying north of the 40th parallel. A succession of West Indies hurricanes was responsible for the unusually large number reported from the Gulf of Mexico and the Caribbean Sea. This is specially noticeable in the 5-degree square between latitudes 25°-30°, longitudes 65°-70°, where gales were reported on 4 days, a percentage of 13, while the normal percentage for this square is less than 1. In an article in the MONTHLY WEATHER REVIEW for December, 1916, 44:686-688 (Hurricanes of 1916 and Notes on Hurricanes of 1912-1915, by R. H. Weightman), three West Indies hurricanes that appeared in July, 1916, were described and plotted. These are shown as tracks *I*, *II*, and *III*, respectively, on Chart IX (XLV-75), *III* being extended from July 20 to July 25.

On July 1 several slight depressions north of the 40th parallel were attended by light to moderate winds, and a low of slight intensity (*I* on Chart IX) was near latitude 16° N., longitude 84° W. By the 2d *I* had moved a short distance toward the north, with its center about 50 miles west of Swan Island, the condition of wind and weather

having changed but little since the previous day. The low continued in its slow northerly movement, without increase of energy until the 4th, when it was near latitude 24° N., longitude 87° W. On that date the barometer had fallen to 29.45 inches, and vessels near the center reported winds of 60 to 65 miles an hour. On the 5th the center was in the vicinity of Pensacola, Fla., where the barometer reading was 29.56 inches. The disturbance then followed a very irregular path, as shown on Chart IX, and on the 10th was near Cairo, Ill.

From July 6 to 11 the atmospheric conditions over the entire ocean were sluggish, with weak gradients and light winds, with fog prevailing along the New England coast during the greater part of the period. On the 12th a low (*II* on Chart IX) was central near latitude 26° N., longitude 75° W., one vessel reporting a southwesterly gale of about 50 miles an hour, with a barometer reading of 29.79 inches. On the 13th this center was near Nassau, but no winds of gale force were reported by any vessel in the vicinity. It continued on its northwesterly course, and on the 14th was central near Charleston, S. C., while on the following day it was in the vicinity of Charlotte, N. C.

On the 12th a low of light intensity was near Barbadoes, and moving rapidly toward the northwest, reaching the island of Porto Rico on the 13th. It was too far south to plot on Chart IX on these dates, but on the 14th it appears as Low *III*, the center being near latitude 21°, longitude 66°; easterly and southeasterly gales of 40 to 50 miles an hour were encountered in the northerly quadrants. The rate of translation was slow during the next three days, for on the 17th the disturbance was near latitude 24°, longitude 71°, where winds of gale to hurricane force were reported during this period, while on the 16th a vessel near latitude 22°, longitude 69°, recorded a northwesterly wind of 90 miles or over, with a barometric reading of 29.33 inches.

The path of *III* curved slightly toward the north, and on the 19th the center was about 100 miles south of Hatteras. Winds of gale force still prevailed, the velocity ranging from 40 to 65 miles an hour over a limited area. On the 20th the center of the disturbance was about 3 degrees east of Norfolk, Va., gales still raging along the coast between the 35th and 38th parallels. It then curved toward the northeast, following the coast line, and on the 21st was central near Nantucket, the force of the wind having moderated considerably since the previous day. On the 22d the disturbance covered the greater part of the Gulf of St. Lawrence, moderate winds and fog prevailing, and then moved rapidly toward the northeast, the center on the 23d being near latitude 52°, longitude 35°, accompanied by moderate southerly gales. It then curved toward the north, and on the 24th was in the vicinity of latitude 53°, longitude 27°, but the area had increased so in extent and so few observations were received from the northern quadrants, it was impossible to locate the center accurately. On the 25th the disturbance was off the south coast of Iceland, the barometer reading at Reykjavik being 29.50 inches.

As stated previously there were few cyclonic disturbances of any force in the northern division of the Atlantic and the winds were for the most part from light to moderate. From the 14th to the 17th, however, there was an area of low pressure of light intensity, that covered an extensive territory in northern waters, and a few reports were received from vessels in widely scattered localities that experienced gales of 40 to 50 miles an hour.

TEMPERATURE.

The average monthly temperature of the air over the ocean, was as a whole, considerably above the normal north of latitude 40, the positive departures ranging from 1 to 5 degrees. Between the 30th and 40th parallels, west of the 30th meridian, it was, for the most part, slightly cooler than usual; the same conditions held true in the waters adjacent to the American coast, while in the Gulf of Mexico the temperature was practically normal. The departures at a number of Canadian and U. S. Weather Bureau stations on the Atlantic and Gulf coasts, were unusually variable, as shown in the following table:

	°F.		°F.
St. Johns, N. F.....	+1.8	Norfolk, Va.....	-1.0
Sydney, C. B. I.....	+1.2	Hatteras, N. C.....	-0.9
Halifax, N. S.....	+1.7	Charleston, S. C.....	-2.2
Eastport, Me.....	-1.0	Key West, Fla.....	-1.4
Portland, Me.....	-0.1	Tampa, Fla.....	+1.6
Boston, Mass.....	+1.3	Mobile, Ala.....	-0.5
Nantucket, Mass.....	-2.1	New Orleans, La.....	+1.0
Block Island, R. I.....	-1.0	Galveston, Tex.....	-0.2
New York, N. Y.....	+0.3	Corpus Christi, Tex.....	0.0

The lowest temperature reported during the month was 48° F., and occurred in the waters adjacent to the east coast of Labrador, between the 50th and 55th parallels; the highest temperature, 58°, was for the same square and was recorded on a number of different days.

FOG.

Off the Banks of Newfoundland, where the number of days on which fog occurs is usually the greatest, it was reported during July, 1916, on 14 days, which is slightly less than usual. On the other hand, over the Nantucket Shoals it was encountered on 20 days, a percentage of 65, while the normal for that region is between 40 and 50 per cent. In mid-ocean and over the eastern portion of the steamer lanes, the amount varied but little from the normal, being slightly above in some localities and below in others.

Winds of 50 mi./hr. (22.4 m./sec.), or over, during July, 1917.

Station.	Date.	Velocity.	Direction.	Station.	Date.	Velocity.	Direction.
		Mis./hr.				Mis./hr.	
Buffalo, N. Y.....	9	72	nw.	Mt. Tamalpais, Cal.	26	54	w.
Columbus, Ohio.....	1	58	nw.	Do.....	27	52	nw.
Duluth, Minn.....	29	54	sw.	New York, N. Y.....	2	50	sw.
Jacksonville, Fla.....	12	50	sw.	Norfolk, Va.....	10	66	nw.
Do.....	14	60	sw.	Do.....	12	55	w.
Do.....	28	54	s.	Do.....	27	54	w.
Do.....	30	52	ne.	Pierre, S. Dak.....	30	70	w.
Memphis, Tenn.....	19	64	nw.	Point Reyes			
Mobile, Ala.....	6	50	n.	Light, Cal.....	27	50	nw.
Mt. Tamalpais, Cal.....	19	54	nw.	Sandy Hook, N. J.....	2	71	s.
Do.....	20	64	nw.	Do.....	14	62	nw.
Do.....	22	56	nw.	San Juan, P. R.....	12	50	e.
Do.....	23	52	w.	Trenton, N. J.....	2	52	w.